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Mario Giacobini et al. (Eds.)

# Applications of Evolutionary Computing

EvoWorkshops 2007: EvoCOMNET, EvoFIN, EvoIASP,  
EvoINTERACTION, EvoMUSART, EvoSTOC and EvoTRANSLOG  
Valencia, Spain, April 11-13, 2007  
Proceedings

Volume Editors

see next page

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# Preface

Evolutionary computation (EC) techniques are efficient nature-inspired planning and optimization methods based on the principles of natural evolution and genetics. Due to their efficiency and simple underlying principles, these methods can be used in the context of problem solving, optimization, and machine learning. A large and continuously increasing number of researchers and professionals make use of EC techniques in various application domains. This volume presents a careful selection of relevant EC examples combined with a thorough examination of the techniques used in EC. These papers illustrate the current state of the art in the application of EC and should help and inspire researchers and professionals to develop efficient EC methods for design and problem solving.

All papers in this book were presented during EvoWorkshops 2007, which was a varying collection of workshops on application-oriented aspects of EC. The year 2007 was especially important for EvoWorkshops, which celebrated their tenth edition. In fact, since 1998, EvoWorkshops has provided a unique opportunity for EC researchers to meet and discuss application aspects of EC and it has been an important link between EC research and its application in a variety of domains. During these ten years, new workshops have arisen, some have disappeared, while others have matured to become conferences of their own, such as EuroGP in 2000, EvoCOP in 2004, and EvoBIO in 2007.

Another fundamental novelty in 2007 was the creation of EVO\*, Europe's premier co-located events in the field of evolutionary computing, unifying EuroGP, the main European event dedicated to genetic programming, EvoCOP, the main European conference on evolutionary computation in combinatorial optimization, EvoBIO, the first European conference on EC and related techniques in bioinformatics and computational biology, and EvoWorkshops. The proceedings for all of these events, EuroGP 2007, EvoCOP 2007 and EvoBIO 2007, are also available in the LNCS series (number 4445, 4446, and 4447). EVO\* was held in Valencia, Spain, during April 11–13, 2007, jointly with the conferences EuroGP 2007, EvoCOP 2007, and EvoBIO 2007.

EvoWorkshops 2007 consisted of the following individual workshops:

- *EvoCOMNET*, the Fourth European Workshop on the Application of Nature-Inspired Techniques to Telecommunication Networks and Other Connected Systems
- *EvoFIN*, the 1st European Workshop on Evolutionary Computation in Finance and Economics
- *EvoIASP*, the Ninth European Workshop on Evolutionary Computation in Image Analysis and Signal Processing
- *EvoInteraction*, the 2nd European Workshop on Interactive Evolution and Humanized Computational Intelligence

- *EvoMUSART*, the Fifth European Workshop on Evolutionary Music and Art
- *EvoSTOC*, the Fourth European Workshop on Evolutionary Algorithms in Stochastic and Dynamic Environments
- *EvoTransLog*, the 1st European Workshop on Evolutionary Computation in Transportation and Logistics

EvoCOMNET addresses the application of EC techniques to problems in communications, networks, and connected systems. New communication technologies, the creation of interconnected communication and information networks such as the Internet, new types of interpersonal and interorganizational communication, and the integration and interconnection of production centers and industries are the driving forces on the road towards a connected, networked society. EC techniques are important tools to be able to face these challenges.

EvoFIN is the first European event specifically dedicated to the applications of EC and related natural computing methodologies, to finance and economics. Financial environments are typically hard, being dynamic, high-dimensional, noisy and co-evolutionary. These environments serve as an interesting test bed for novel evolutionary methodologies. The papers for this year's workshop encompassed several key topics in finance including portfolio optimization, time series forecasting, risk management, failure prediction, agent behavior, and options pricing.

EvoIASP, the longest-running of all EvoWorkshops which reached its ninth edition in 2007, has been the first international event solely dedicated to the applications of EC to image analysis and signal processing in complex domains of high industrial and social relevance.

EvoInteraction deals with various aspects of interactive evolution, and more broadly of computational intelligence in interaction with human intelligence, including methodology, theoretical issues, and new applications. Interaction with humans raises several problems, mainly linked to what has been called the user bottleneck, i.e., human fatigue.

EvoMUSART focuses on the use of EC techniques for the development of creative systems. There is a growing interest in the application of these techniques in fields such as art, music, architecture, and design. The goal of EvoMUSART is to bring together researchers that use EC in this context, providing an opportunity to promote, present, and discuss the latest work in the area, fostering its further developments and collaboration among researchers.

EvoSTOC addresses the application of EC in stochastic environments. This includes optimization problems with changing, noisy, and/or approximated fitness functions and optimization problems that require robust solutions. These topics recently gained increasing attention in the EC community and EvoSTOC was the first workshop that provided a platform to present and discuss the latest research in this field.

EvoTransLog deals with all aspects of the use of evolutionary computation, local search and other nature-inspired optimization and design techniques for the transportation and logistics domain. The impact of transportation and logistics

on the modern economy and society has been growing steadily over the last few decades. Along with the development of more powerful computer systems, design and optimization techniques such as evolutionary computing approaches have been developed allowing one to use computer systems for systematic design, optimization, and improvement of systems in the transportation and logistics domain.

EvoWorkshops 2007 continued the tradition of providing researchers, as well as people from industry, students, and interested newcomers, with an opportunity to present new results, discuss current developments and applications, or simply become acquainted with the world of EC. Moreover, it encourages and reinforces future possible synergies and interactions between members of all scientific communities that may benefit from EC techniques.

This year, the EvoWorkshops had the highest number of submissions ever, cumulating at 160 entries (with respect to 143 in 2005 and 149 in 2006). EvoWorkshops 2007 accepted ten-page full papers and eight-page short papers. Full papers were presented orally over the three conference days, while short papers were presented and discussed during a special poster session. The low acceptance rate of 34.37% for EvoWorkshops 2007, the lowest of all past editions, along with the significant and still-growing number of submissions is an indicator of the high quality of the articles presented at the workshops, showing the liveliness of the scientific movement in the corresponding fields. The following table shows relevant statistics for EvoWorkshops 2006 and EvoWorkshops 2007 (accepted short papers are in brackets):

Year	2007			2006		
	Submissions	Accept	Ratio	Submissions	Accept	Ratio
EvoCOMNET	44	11(7)	25%	16	5	31.2%
EvoFIN	13	6(2)	46.15%	-	-	-
EvoIASP	35	11(10)	31.43%	35	12(7)	34.3%
EvoInteraction	7	4	57.14%	8	6	75%
EvoMUSART	30	10(5)	33.33%	29	10(4)	34.5%
EvoSTOC	11	5	45.45%	12	6(2)	50.0%
EvoTransLog	20	8	40%	-	-	-
Total	160	55(24)	34.37%	149	65(13)	43.6%

We would like to thank the following institutions:

- The Universidad Politécnica de Valencia, for its institutional and financial support and for providing premises and administrative assistance
- The Instituto Tecnológico de Informatica in Valencia, for cooperation and help with local arrangements
- The Spanish Ministerio de Educación y Ciencia, for their financial contribution
- The Centre for Emergent Computing at Napier University in Edinburgh, Scotland, for administrative help and event coordination

Even with an excellent support and location, an event like EVO\* would not have been feasible without authors submitting their work, members of the Program Committees dedicating energy in reviewing those papers, and an audience. All these people deserve our gratitude.

Finally, we are grateful to all those involved in the preparation of the event, especially Jennifer Willies for her unaltered dedication to the coordination of the event over the years. Without her support, running such a type of conference with a large number of different organizers and different opinions would be unmanageable. Further thanks to the local organizer Anna I. Esparcia-Alcázar, Ken Sharman, and the Complex Adaptive Systems group of the Instituto Tecnológico de Informática for making the organization of such an event possible in a place as unique as Valencia. Last but surely not least, we want to especially acknowledge Leonardo Vanneschi for his hard work as Publicity Chair of the event, and Marc Schoenauer for his continuous help in setting up and maintaining the conference portal.

April 2007	Mario Giacobini	Anthony Brabazon	Stefano Cagnoni
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# Organization

EvoWorkshops 2007 was part of EVO\* 2007, Europe's premier co-located events in the field of evolutionary computing, that also included the conferences EuroGP 2007, EvoCOP 2007, and EvoBIO 2007.

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# Table of Contents

## EvoCOMNET Contributions

Performance of Ant Routing Algorithms When Using TCP .....	1
<i>Malgorzata Gadomska and Andrzej Pacut</i>	
Evolving Buffer Overflow Attacks with Detector Feedback .....	11
<i>H. Gunes Kayacik, Malcolm Iain Heywood, and A. Nur Zincir-Heywood</i>	
Genetic Representations for Evolutionary Minimization of Network Coding Resources .....	21
<i>Minkyu Kim, Varun Aggarwal, Una-May O'Reilly, Muriel Médard, and Wonsik Kim</i>	
Bacterial Foraging Algorithm with Varying Population for Optimal Power Flow .....	32
<i>M.S. Li, W.J. Tang, W.H. Tang, Q.H. Wu, and J.R. Saunders</i>	
An Ant Algorithm for the Steiner Tree Problem in Graphs .....	42
<i>Luc Luyet, Sacha Varone, and Nicolas Zufferey</i>	
Message Authentication Protocol Based on Cellular Automata .....	52
<i>Angel Martín del Rey</i>	
An Adaptive Global-Local Memetic Algorithm to Discover Resources in P2P Networks .....	61
<i>Ferrante Neri, Niko Kotilainen, and Mikko Vapa</i>	
Evolutionary Computation for Quality of Service Internet Routing Optimization .....	71
<i>Miguel Rocha, Pedro Sousa, Paulo Cortez, and Miguel Rio</i>	
BeeSensor: A Bee-Inspired Power Aware Routing Protocol for Wireless Sensor Networks .....	81
<i>Muhammad Saleem and Muddassar Farooq</i>	
Radio Network Design Using Population-Based Incremental Learning and Grid Computing with BOINC .....	91
<i>Miguel A. Vega-Rodríguez, David Vega-Pérez, Juan A. Gómez-Pulido, and Juan M. Sánchez-Pérez</i>	
Evaluation of Different Metaheuristics Solving the RND Problem .....	101
<i>Miguel A. Vega-Rodríguez, Juan A. Gómez-Pulido, Enrique Alba, David Vega-Pérez, Silvio Priem-Mendes, and Guillermo Molina</i>	

A Comparative Investigation on Heuristic Optimization of WCDMA Radio Networks .....	111
<i>Mehmet E. Aydin, Jun Yang, and Jie Zhang</i>	
Design of a User Space Software Suite for Probabilistic Routing in Ad-Hoc Networks .....	121
<i>Frederick Ducatelle, Martin Roth, and Luca Maria Gambardella</i>	
Empirical Validation of a Gossiping Communication Mechanism for Parallel EAs .....	129
<i>Juan Luís Jiménez Laredo, Pedro Angel Castillo, Ben Paechter, Antonio Miguel Mora, Eva Alfaro-Cid, Anna I. Esparcia-Alcázar, and Juan Julián Merelo</i>	
A Transport-Layer Based Simultaneous Access Scheme in Integrated WLAN/UMTS Mobile Networks .....	137
<i>Hyung-Taig Lim, Seung-Joon Seok, and Chul-Hee Kang</i>	
Simplified Transformer Winding Modelling and Parameter Identification Using Particle Swarm Optimiser with Passive Congregation .....	145
<i>Almas Shintemirov, W.H. Tang, Z. Lu, and Q.H. Wu</i>	
A Decentralized Hierarchical Aggregation Scheme Using Fermat Points in Wireless Sensor Networks .....	153
<i>Jeongho Son, Jinsuk Pak, Hyunsook Kim, and Kijun Han</i>	
A Gateway Access-Point Selection Problem and Traffic Balancing in Wireless Mesh Networks .....	161
<i>Ahmet Cagatay Talay</i>	

## EvoFIN Contributions

A Genetic Programming Approach for Bankruptcy Prediction Using a Highly Unbalanced Database .....	169
<i>Eva Alfaro-Cid, Ken Sharman, and Anna I. Esparcia-Alcázar</i>	
Multi-objective Optimization Technique Based on Co-evolutionary Interactions in Multi-agent System .....	179
<i>Rafał Dreżewski and Leszek Siwik</i>	
Quantum-Inspired Evolutionary Algorithms for Calibration of the VG Option Pricing Model .....	189
<i>Kai Fan, Anthony Brabazon, Conall O'Sullivan, and Michael O'Neill</i>	
An Evolutionary Computation Approach to Scenario-Based Risk-Return Portfolio Optimization for General Risk Measures .....	199
<i>Ronald Hochreiter</i>	

Building Risk-Optimal Portfolio Using Evolutionary Strategies.....	208
<i>Piotr Lipinski, Katarzyna Winczura, and Joanna Wojcik</i>	
Comparison of Evolutionary Techniques for Value-at-Risk Calculation .....	218
<i>Gonul Uludag, A. Şima Uyar, Kerem Senel, and Hasan Dag</i>	
Using Kalman-Filtered Radial Basis Function Networks to Forecast Changes in the ISEQ Index .....	228
<i>David Edelman</i>	
Business Intelligence for Strategic Marketing: Predictive Modelling of Customer Behaviour Using Fuzzy Logic and Evolutionary Algorithms .....	233
<i>Andrea G.B. Tettamanzi, Maria Carlesi, Lucia Pannese, and Mauro Santalmasi</i>	

## EvoIASP Contributions

Particle Swarm Optimization for Object Detection and Segmentation ...	241
<i>Stefano Cagnoni, Monica Mordonini, and Jonathan Sartori</i>	
Satellite Image Registration by Distributed Differential Evolution .....	251
<i>Ivanoe De Falco, Antonio Della Cioppa, Domenico Maisto, Umberto Scafuri, and Ernesto Tarantino</i>	
Harmonic Estimation Using a Global Search Optimiser .....	261
<i>Y.N. Fei, Z. Lu, W.H. Tang, and Q.H. Wu</i>	
An Online EHW Pattern Recognition System Applied to Face Image Recognition .....	271
<i>Kyrre Glette, Jim Torresen, and Moritoshi Yasunaga</i>	
Learning and Recognition of Hand-Drawn Shapes Using Generative Genetic Programming .....	281
<i>Wojciech Jaśkowski, Krzysztof Krawiec, and Bartosz Wieloch</i>	
Multiclass Object Recognition Based on Texture Linear Genetic Programming.....	291
<i>Gustavo Olague, Eva Romero, Leonardo Trujillo, and Bir Bhanu</i>	
Evolutionary Brain Computer Interfaces .....	301
<i>Riccardo Poli, Caterina Cinel, Luca Citi, and Francisco Sepulveda</i>	
A Genetic Programming Approach to Feature Selection and Classification of Instantaneous Cognitive States .....	311
<i>Rafael Ramirez and Montserrat Puiggros</i>	



A Memetic Differential Evolution in Filter Design for Defect Detection in Paper Production . . . . .	320
<i>Ville Tirronen, Ferrante Neri, Tommi Karkkainen, Kirsi Majava, and Tuomo Rossi</i>	
Optimal Triangulation in 3D Computer Vision Using a Multi-objective Evolutionary Algorithm . . . . .	330
<i>Israel Vite-Silva, Nareli Cruz-Cortés, Gregorio Toscano-Pulido, and Luis Gerardo de la Fraga</i>	
Genetic Programming for Image Recognition: An LGP Approach . . . . .	340
<i>Mengjie Zhang and Christopher Graeme Fogelberg</i>	
Evolving Texture Features by Genetic Programming . . . . .	351
<i>Melanie Aurnhammer</i>	
Euclidean Distance Fit of Ellipses with a Genetic Algorithm . . . . .	359
<i>Luis Gerardo de la Fraga, Israel Vite Silva, and Nareli Cruz-Cortés</i>	
A Particle Swarm Optimizer Applied to Soft Morphological Filters for Periodic Noise Reduction . . . . .	367
<i>T.Y. Ji, Z. Lu, and Q.H. Wu</i>	
Fast Genetic Scan Matching Using Corresponding Point Measurements in Mobile Robotics . . . . .	375
<i>Kristijan Lenac, Enzo Mumolo, and Massimiliano Nolic</i>	
Overcompressing JPEG Images with Evolution Algorithms . . . . .	383
<i>Jacques Lévy Véhel, Franklin Mendivil, and Evelynne Lutton</i>	
Towards Dynamic Fitness Based Partitioning for IntraVascular UltraSound Image Analysis . . . . .	391
<i>Rui Li, Jeroen Eggermont, Michael T.M. Emmerich, Ernst G.P. Bovenkamp, Thomas Bäck, Jouke Dijkstra, and Johan H.C. Reiber</i>	
Comparison Between Genetic Algorithms and the Baum-Welch Algorithm in Learning HMMs for Human Activity Classification . . . . .	399
<i>Óscar Pérez, Massimo Piccardi, Jesús García, Miguel Ángel Patricio, and José Manuel Molina</i>	
Unsupervised Evolutionary Segmentation Algorithm Based on Texture Analysis . . . . .	407
<i>Cynthia Beatriz Pérez and Gustavo Olague</i>	
Evolutionary Approaches for Automatic 3D Modeling of Skulls in Forensic Identification . . . . .	415
<i>Jose Santamaría, Oscar Cordon, and Sergio Damas</i>	

Scale Invariance for Evolved Interest Operators .....	423
<i>Leonardo Trujillo and Gustavo Olague</i>	
Application of the Univariate Marginal Distribution Algorithm to Mixed Analogue - Digital Circuit Design and Optimisation .....	431
<i>Lyudmila Zinchenko, Matthias Radecker, and Fabio Bisogno</i>	

## EvoINTERACTION Contributions

Interactive Texture Design Using IEC Framework .....	439
<i>Tsuneo Kagawa, Yukihide Tamotsu, Hiroaki Nishino, and Kowichi Utsumiya</i>	
Towards an Interactive, Generative Design System: Integrating a ‘Build and Evolve’ Approach with Machine Learning for Complex Freeform Design .....	449
<i>Azahar T. Machwe and Ian C. Parmee</i>	
An Interactive Graphics Rendering Optimizer Based on Immune Algorithm .....	459
<i>Hiroaki Nishino, Takuya Sueyoshi, Tsuneo Kagawa, and Kowichi Utsumiya</i>	
Human Mosaic Creation Through Agents and Interactive Genetic Algorithms Applied to Videogames Movements .....	470
<i>Oscar Sanjuán, Gloria García, Yago Sáez, and Cristobal Luque</i>	

## EvoMUSART Contributions

Self-organizing Bio-inspired Sound Transformation .....	477
<i>Marcelo Caetano, Jônatas Manzolli, and Fernando Von Zuben</i>	
An Evolutionary Approach to Computer-Aided Orchestration .....	488
<i>Grégoire Carpentier, Damien Tardieu, Gérard Assayag, Xavier Rodet, and Emmanuel Saint-James</i>	
Evolution of Animated Photomosaics .....	498
<i>Vic Ciesielski, Marsha Berry, Karen Trist, and Daryl D’Souza</i>	
Environments for Sonic Ecologies .....	508
<i>Tom Davis and Pedro Rebelo</i>	
Creating Soundscapes Using Evolutionary Spatial Control .....	517
<i>José Fornari, Adolfo Maia Jr., and Jônatas Manzolli</i>	
Toward Greater Artistic Control for Interactive Evolution of Images and Animation .....	527
<i>David A. Hart</i>	

Evolutionary Assistance in Alliteration and Allelic Drivel . . . . .	537
<i>Raquel Hervás, Jason Robinson, and Pablo Gervás</i>	
Evolutionary GUIs for Sound Synthesis . . . . .	547
<i>James McDermott, Niall J.L. Griffith, and Michael O'Neill</i>	
Evolving Music Generation with SOM-Fitness Genetic Programming . . .	557
<i>Somnuk Phon-Amnuaisuk, Edwin Hui Hean Law, and Ho Chin Kuan</i>	
An Automated Music Improviser Using a Genetic Algorithm Driven Synthesis Engine . . . . .	567
<i>Matthew John Yee-King</i>	
Interactive GP with Tree Representation of Classical Music Pieces . . . . .	577
<i>Daichi Ando, Palle Dahlsted, Mats G. Nordahl, and Hitoshi Iba</i>	
Evolutionary Methods for Melodic Sequences Generation from Non-linear Dynamic Systems . . . . .	585
<i>Eleonora Bilotta, Pietro Pantano, Enrico Cupellini, and Costantino Rizzuti</i>	
Music Composition Using Harmony Search Algorithm . . . . .	593
<i>Zong Woo Geem and Jeong-Yoon Choi</i>	
Curve, Draft, and Style: Three Steps to the Image . . . . .	601
<i>Olgierd Unold and Maciej Troc</i>	
GISMO2: An Application for Agent-Based Composition . . . . .	609
<i>Yuta Uozumi</i>	

## EvoSTOC Contributions

Variable-Size Memory Evolutionary Algorithm to Deal with Dynamic Environments . . . . .	617
<i>Anabela Simões and Ernesto Costa</i>	
Genetic Algorithms with Elitism-Based Immigrants for Changing Optimization Problems . . . . .	627
<i>Shengxiang Yang</i>	
Triggered Memory-Based Swarm Optimization in Dynamic Environments . . . . .	637
<i>Hongfeng Wang, Dingwei Wang, and Shengxiang Yang</i>	
Experimental Comparison of Replacement Strategies in Steady State Genetic Algorithms for the Dynamic MKP . . . . .	647
<i>A. Şima Uyar</i>	

Understanding the Semantics of the Genetic Algorithm in Dynamic Environments .....	657
<i>Abir Alharbi, William Rand, and Rick Riolo</i>	

## **EvoTRANSLOG Contributions**

Simultaneous Origin-Destination Matrix Estimation in Dynamic Traffic Networks with Evolutionary Computing .....	668
<i>Theodore Tsekeris, Loukas Dimitriou, and Antony Stathopoulos</i>	
Evolutionary Combinatorial Programming for Discrete Road Network Design with Reliability Requirements .....	678
<i>Loukas Dimitriou, Theodore Tsekeris, and Antony Stathopoulos</i>	
Intelligent Traffic Control Decision Support System .....	688
<i>Khaled Almejalli, Keshav Dahal, and M. Alamgir Hossain</i>	
An Ant-Based Heuristic for the Railway Traveling Salesman Problem .....	702
<i>Petrica C. Pop, Camelia M. Pintea, and Corina Pop Sitar</i>	
Enhancing a MOACO for Solving the Bi-criteria Pathfinding Problem for a Military Unit in a Realistic Battlefield .....	712
<i>Antonio Miguel Mora, Juan Julian Merele, Cristian Millan, Juan Torrecillas, Juan Lu�s Jim�nez Laredo, and Pedro A. Castillo</i>	
GRASP with Path Relinking for the Capacitated Arc Routing Problem with Time Windows .....	722
<i>Mohamed Reghioui, Christian Prins, and Nacima Labadi</i>	
Multi-objective Supply Chain Optimization: An Industrial Case Study .....	732
<i>Lionel Amodeo, Hao�un Chen, and Aboubacar El Hadji</i>	
Scheduling a Fuzzy Flowshop Problem with Flexible Due Dates Using Ant Colony Optimization .....	742
<i>Sezgin Kilic</i>	
<b>Author Index</b> .....	753